



SSC - CGL

COMBINED GRADUATE LEVEL

STAFF SELECTION COMMISSION

VOLUME – V

Arithmetic



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PERCENTAGE

Percent word is formed by two words "Per" and "Cent".

Percent

```

    graph TD
      Percent --> 1
      Percent --> 100
      1 --- OneHundred[1 / 100]
      100 --- XPercent[X% = x / 100]
  
```

~~One by hundredth part of anything is percent. It is represented by sign % and to put the % in the end of any number. We multiply the number by 100.~~

$$16\% = \frac{16}{100}$$

$$16 = 16 \times 100\% = 1600\%$$

$$18\% = \frac{18}{100}$$

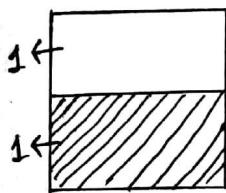
$$18 = 18 \times 100\% = 1800\%$$

$$20\% = \frac{20}{100}$$

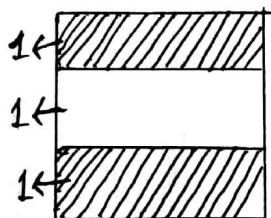
$$\frac{2}{5} = \frac{2}{5} \times 100\% = 40\%$$

Fraction:

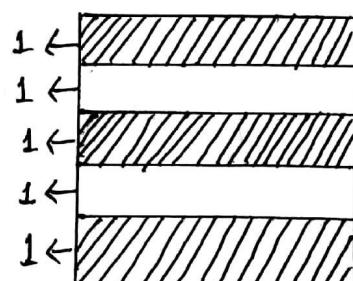
Any small or tiny part or proportion of something is represented in fraction.



$$\text{White part} = \frac{1}{2}$$



$$\text{White part} = \frac{1}{3}$$



$$\text{White part} = \frac{2}{5}$$

All diagram above are divided in equal parts and fraction that white part is what fraction of whole diagram.

→ $\frac{\text{Numerator}}{\text{Denominator}}$ → Small part of whole number
 → Whole number

→ To make our questions easier, we keep remember few converts, percentage to fraction and fraction to percentage.

$$1 = 1 \times 100\% = 100\%$$

$$\frac{1}{2} = \frac{1}{2} \times 100\% = 50\%$$

$$\frac{1}{3} = 33\frac{1}{3}\%$$

$$\frac{1}{4} = 25\%$$

$$\frac{1}{5} = 20\%$$

$$\frac{1}{6} = 16\frac{2}{3}\%$$

$$\frac{1}{7} = 14\frac{2}{7}\%$$

$$\frac{1}{8} = 12.5\%$$

$$\frac{1}{9} = 11\frac{1}{9}\% = 11.11\%$$

$$\frac{2}{9} = 22.22\%, \frac{3}{9} = 33.33\%, \frac{5}{9} = 55.55\%$$

$$\frac{1}{10} = 10\%$$

$$\frac{1}{11} = 9\frac{1}{11}\% = 9.09\%, \frac{4}{11} = 36.36\%$$

$$\frac{1}{12} = 8\frac{1}{3}\%$$

$$\frac{1}{13} = 7\frac{9}{13}\%$$

$$\frac{1}{14} = 7\frac{1}{7}\% = 7.14\%$$

$$\frac{1}{15} = 6\frac{2}{3}\%$$

$$\frac{1}{16} = 6\frac{1}{4}\%$$

→ Formulas of percentage:

$$\% \text{ Change} = \frac{\text{Final Value} - \text{Initial Value}}{\text{Initial Value}} \times 100$$

$$\text{Increased Value / Final Value} = \frac{\text{Initial Value} \times \left\{ \frac{100 + \text{Increase}\%}{100} \right\}}{\text{Initial Value}}$$

$$\text{Increased Value / Final Value} = \text{Initial value} \times \left\{ \frac{100 - \text{Decrease}\%}{100} \right\}$$

$$\text{Initial value} = \text{Final Value} \times \left(\frac{100}{100 - (\text{decrease}\%)} \right)$$

$$\text{Resultant percentage change} = \left(\frac{(x+y) + \frac{x+y}{100}}{100} \right)$$

For increase we take percent "+", for decrease we take percent "-".

PRACTICE EXAMPLES

Q. 1 If a fruit seller sells 40% of his total apples then he is now left with 480 apples. How many apples had he originally?

Sol:

Basic: Let total no. of apples are x
 Seller Sells = $x \times \frac{40}{100}$ apples
 Remaining apples = $x - \frac{x \times 40}{100}$

$$\frac{100x - 40x}{100} = 480 \text{ (Given in question)}$$

$$\frac{60x}{100} = 480$$

$$x = 800 \text{ apples.}$$

Trick:

Everything is 100% in itself
 so after selling 40%, a man is left with only 60%.

$$60\% = 480$$

$$1\% = 8$$

$$100\% = 800$$

Q. 2 A book seller has total 6300 books and he sells 90% of all. How many books are still unsold?

Sol:

$$100\% = 6300$$

$$1\% = 63$$

$$\text{He is now left with only } (100\% - 90\%) = 10\%.$$

$$\text{so } 10\% = 630$$

Q. 3 If monthly salary of an employee is increased by 8/3%, he gets 72 rupee more. His monthly salary is?

Sol:

Basic: Let his salary is x

Salary after increment $x \times (100 + \frac{8}{3})$

$$= x \times \frac{308}{300}$$

Trick:

% increase is equal to increase in number.

$$\frac{8}{3}\% = 72$$

$$1\% = 27$$

$$100\% = 2700$$

$$\text{Difference} = \left(x \times \frac{308}{300} - x \right) = 72$$

$$= \frac{8x}{300} = 72$$

$$= x = 2700 \text{ ₹}$$

Q. 4 The population of town in 2019 is 2100. In the next year it increases by 21%, what is the increased population of village in 2020?

Sol:

$$\text{Increased Value} = \text{Initial Value} \times \frac{(100 + \text{Increase})}{100}$$

$$= 2100 \times \frac{21}{100}$$

$$= 2541$$

Trick:

Initial	Increased value
100	121
$\downarrow \times 21$	$\downarrow \times 21$

$$2100 \quad 2541$$

Q. 5 If the numerator of the fraction is increased by 20% denominator is decreased by 5%. The value of the new fraction becomes $\frac{5}{2}$. What is the original fraction?

Sol: Let the no. is $\frac{x}{y}$

$$\Rightarrow \frac{x \times \left(100 + 20\right)}{y \times \left(100 - 5\right)} = \frac{x \times 120}{y \times 95}$$

$$\Rightarrow \frac{x \times 120}{y \times 95} = \frac{5}{2} \quad \Rightarrow \frac{x}{y} = \frac{5 \times 95}{2 \times 120} = \frac{95}{48}$$

Q. 6 When a number is increased by 24, it becomes 104% of itself. What is the number?

Sol:

Basic: Let number is x

then

$$x + 24 = \frac{104}{100} \times x$$

$$24 = \frac{104}{100} x - x$$

$$24 = \frac{4x}{100}$$

$$x = 600$$

Trick:

Every no. is 100% in itself.
So increase is 4%.

$$4\% = 24$$

$$1\% = 6$$

$$100\% = 600$$

Q. 7 5 is what percent of 25?

sol: $= \frac{5}{25} \times 100 = 20\%$.

Q. 8 A number is increased from 21 to 84. What is the percentage change in the number?

sol: 300 %

Q. 9 If $\frac{1}{5}$ th of the soldiers in a battalion are equal to 500 then what is total number of soldiers in the battalion.

sol: 2500

Q. 10 If the numerator of the fraction is increased by 35% and denominator is also increased by 20%, the value of the new fraction becomes $\frac{9}{6}$. What is the original fraction?

sol: $\frac{4}{3}$

Q. 11 When a number is increased by 39, it becomes 113% of itself. What is the number?

sol: 300

Q. 12 When 40 is subtracted from 40% of a number, the result is 80. The number is?

sol: 300

INCREASE/DECREASE TO DECREASED/ INCREASED NO:

Q. 13 If A's income is 25% less than B, how much percent B's income more than that of A?

sol: Let B's income x.

So A's income = $\frac{x - 75}{100} x$

Trick:

A's income B's income
 $\xrightarrow{75} \quad \quad \quad \xrightarrow{100}$

$$= \frac{25}{75} \times 100$$

$$= 33\frac{1}{3}\%$$

So percent increase in B's income

$$= \frac{x - \frac{75}{100} x}{\frac{75}{100} x} \times 100$$

$$= \frac{\frac{25}{100} x}{\frac{75}{100} x} \times 100 = 33\frac{1}{3}\%$$

Q. 14 The price of sugar is increased by $\frac{100}{3}\%$. If the expenditure is not allowed to increase for a housewife, by what percent should she reduce consumption.

Sol:

Price	Quantity/Consumption
$\frac{100}{3}\% = \frac{1}{3} (\uparrow)$	$\frac{1}{4} (\downarrow) = 25\%$

If there is increase or decrease in one side than to equal things, we use short trick :

$$\frac{\text{Numerator}}{\text{Denominator}} (\uparrow) \rightarrow \text{then} \rightarrow \frac{\text{Numerator}}{\text{Numerator} + \text{Denominator}} (\downarrow)$$

$$\frac{\text{Numerator}}{\text{Denominator}} (\downarrow) \rightarrow \text{then} \rightarrow \frac{\text{Numerator}}{\text{Denominator} - \text{Numerator}} (\uparrow)$$

Q. 15 If the length of a rectangle is increased by 60% then by what percent should breadth of that be reduced so area remains the same?

Sol: Length Breadth.

$$60\% = \frac{6}{10} \uparrow \quad \frac{6}{10+6} = \frac{6}{16} \downarrow = 37.5\%$$

Q. 16 A number is increased by $y\%$ to get back to the original number, it is to be reduced by?

$$y\% = \frac{y}{100} (\uparrow) \quad = \frac{y}{100+y} \% (\downarrow)$$

Q. 17 If the radius of the cylinder is decreased by 40% then by what percent the height of that should be increased so curved surface area remain the same?

Sol: $66\frac{2}{3}\%$

Q. 18 The price of wine is increased by 25%. If the expenditure is not allowed to increase for a drunkard, by what percent should he reduce consumption?

Sol: 20 %

RESULTANT CHANGE IN:

Q. 19 Salary of a person is first increased by 10%, then it is again increased by 10%, then the percentage change in his salary is?

Sol:

Let salary is 100

$$\text{then first increase} = 100 \times \frac{110}{100} = 110$$

$$\text{Second increase} = 110 \times \frac{110}{100} = 121$$

$$\% \text{ Change} = \left(\frac{121 - 100}{100} \right) \times 100 = 21\%$$

Trick:

$$\begin{aligned} &\text{Use formula given in the introduction part of percentage} \\ &= x + y + \frac{xy}{100} \\ &= 10 + 10 + \frac{10 \times 10}{100} \\ &= 21\% \end{aligned}$$

Q. 20 The price of sugar is increased by 20% and its consumption is decreased by 10% then what is the net effect on the expenditure?

Sol:

$$\begin{aligned} &= x + y + \frac{xy}{100} \\ &= +20\% - 10\% + \frac{20\% \times -10\%}{100} \\ &= 10\% - 2 \\ &= 8\% \text{ increase} \end{aligned}$$

Q. 21 The price of an article is first decreased by 20% and then increased by 30%. If the resulting price is Rs 416, the original price of the article is?

Sol:

$$\begin{aligned} &x + y + \frac{xy}{100} \\ &= -20 + 30 + \frac{-20 \times 30}{100} \\ &= 10 - 6 = 4\% \text{ increase} \\ &\text{Initial price} \times \left(\frac{100 + \text{increase}}{100} \right) = \text{Final result} \\ &\text{Initial price} \times \left(\frac{104}{100} \right) = 416 \\ &\text{I.P} = 400 \text{ Rs} \end{aligned}$$

Q. 22 A number is first decreased by 60% then 40%. What is the net change in the price of the sugar?

Sol: 76 % DECREASE

Q. 23 The price of an article was increased by R%. Later the new price was decreased by R%. If the latest price was Rs. 1, then the original price was?

$$\text{Sol: } \frac{10000}{10000 - R^2}$$

Q. 24 The price of milk is increased by 20% and again by 30%. By what percent should we reduce the new price of milk so as to restore the original price?

$$\text{Sol: } 35 \frac{35}{39} \%$$

MARKS BASED QUESTIONS

Q. 25 Katrina required 33% marks to pass an examination but she got only 21% marks and was declared fail by 18 marks. Find out the total marks of the examination?

Sol:

Basic:

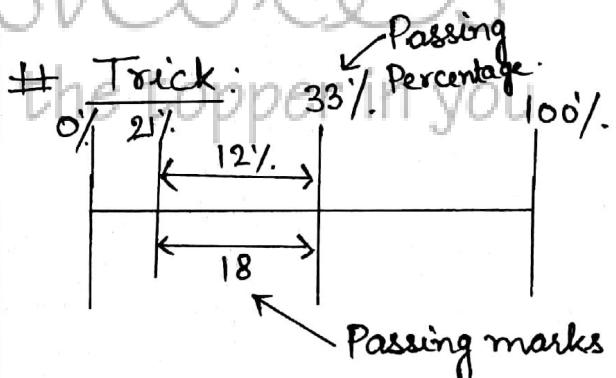
Let total marks are x

$$x \times 21\% + 18 = x \times 33\%$$

$$x \times 33\% - x \times 21\% = 18$$

$$x \times 12\% = 18$$

$$x = \frac{18}{12} \times 100 = 150$$



$$12\% = 18$$

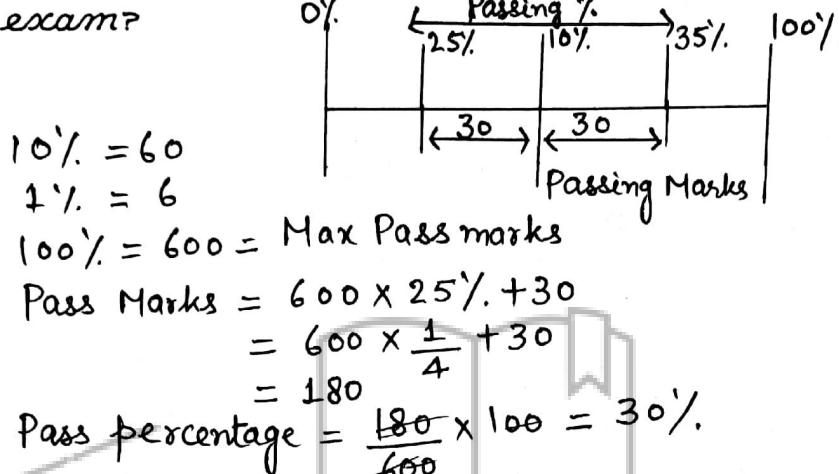
$$1\% = \frac{18}{12}$$

$$100\% = \frac{18}{12} \times 100$$

$$= 150 \text{ Marks.}$$

Q. 26 In a test a student got 25% marks and failed by 30 marks. In the same test another student got 35% and secured 30 more marks than passing marks. What are the maximum pass marks and what is the pass percentage of the exam?

Sol:



Q. 27 In an examination a candidate must secure 35% marks to pass. A candidate, who gets 100 marks, fails by 5 marks. Find the maximum marks for the examination?

Sol: 300

Q. 28 In a test a student got 35% marks and failed by 25 marks. In the same test another student got 48% marks and secured 20% marks more than the essential minimum pass marks. The maximum pass marks for the test were?

Sol: 500

INCREASED OR DECREASED PRICE:

Q. 29 Due to an increase of 20% in the price of apples, a man can buy 5 kg apples less for Rs. 600. Find out the difference between present price and original price?

Sol:

Basic: Present price = 600 ₹

Increased price for same qty = $\frac{600 \times 120}{100} = 720$

5 kg apples rate = $120 - 600 = \frac{100}{120}$ ₹

Present rate = 1 kg apple rate = $\frac{120}{25} = 24$ ₹

Initial price = $20 \times \frac{5}{5} = 20$ ₹

Difference b/w present price and initial price = $24 - 20 = 4$ ₹

Trick:

Price Quantity
 $20\% = \frac{1}{5}$ $5 \leftarrow \frac{1}{5}$ change in qty.
 $30 \leftarrow 6$ initial qty.

Present qty = $30 - 5 = 25$

Initial price = $\frac{600}{30} = 20$ ₹

Present price = $\frac{600}{25} = 24$ ₹

Difference = $24 - 20 = 4$ ₹

Q. 30 A reduction of 25% in the price of rice enables Rampyari to buy two kg more rice for Rs. 240. The reduced per kg price of rice is?

Sol:

~~Price~~

$$25\% = \frac{1}{4} (\downarrow)$$

~~Quantity~~

$$\begin{array}{l} 2 \text{ kg} \leftarrow \frac{1}{3} (\uparrow) \text{ change in quantity} \\ 6 \text{ kg} \leftarrow \text{initial quantity} \end{array}$$

$$\text{Present quantity} = 6 \text{ kg} + 2 \text{ kg} = 8 \text{ kg}$$

$$\text{Reduced price / Present price} = \frac{240}{8} = 30$$

Q. 31 The government reduced the price of rice of sugar by 10%. By this a consumer can buy 6.2 kg more sugar for Rs. 837. The reduced price per kg and original price per kg of sugar separately are?

Sol: 13.5 AND 15

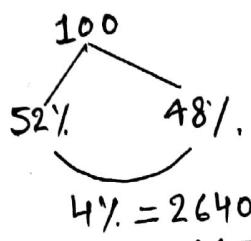
Q. 32 Due to an increase of 50% in the price of the eggs, 4 eggs less are available for Rs. 48. The present rate of eggs per dozen is?

Sol: 72

VOTER BASED QUESTION:

Q. 33 In an election, there are two candidates, one candidate gets 52% of the total votes and won the election by 2640. Tell the total no of votes and how many votes does loser get?

Sol: Let total no. of votes are 100



{ Everything is 100% in itself.
so if winner gets 52%, then
loser gets $(100 - 52) = 48\%$.

$$\text{Total Votes } 100\% = 66000$$

$$\text{Votes of loser} = 660 \times 48 = 31680$$

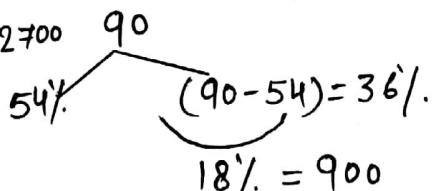
Q. 34 In an election, there are two candidates, 10% votes are found invalid and winning candidate gets 54% of total votes and won the election by 900 votes. Then find the total no of votes casted and how many were the votes gotten by winning candidate?

Sol:

Let total votes are 100

$$\text{Total votes} - 100\% = 50 \times 100 = 5000 \downarrow - 10\% - \text{Invalid votes}$$

$$\text{Winners votes} = 54 \times 50 = 2700$$



Q. 35 In an election between two candidates, 75% of the voters cast their votes, out of which 2% votes were declared invalid. A candidate got 9261 votes which were 75% of the valid votes. The total no of voters enrolled in the election was?

Sol:

Let total votes are 100

$$\begin{aligned}
 & 100 \\
 & \downarrow \\
 & 75 - \text{Valid + Invalid votes} \\
 & \downarrow \\
 & 75 \times \frac{98}{100} = 73.5 - \text{Valid votes} \\
 \Rightarrow & 73.5 \times \frac{75}{100} = 9261 \quad (\text{Given in question}) \\
 & 1 = 168
 \end{aligned}$$

$$\begin{aligned}
 \text{Total no. of voters enrolled in} &= 168 \times 75 \\
 &= 12600
 \end{aligned}$$

Q. 36 In an election, there are two candidates, 20% votes are found invalid and winning candidate gets 54% of total votes and won the election by 560 votes. Then find the total no of votes casted. And how many were the votes gotten by winning candidate?

sol: 2000, 1080

Q. 37 There are two candidates in an election. 20% voters didn't cast their votes while 500 votes were found invalid. winning candidate got 60% of the total valid votes and he won by 8000 votes. Tell the total no of votes that voter casted?

sol: 40500

Unleash the topper in you

DISTRIBUTED EXPENDITURE AND SAVING:

Q. 38 Anisha spends 40% of her salary on food, 20% on house rent, 10% on entertainment and 10% on conveyance. If her savings at the end of a month is Rs. 1500, then her salary per month is?

sol: Everything is 100% in itself.

$$\begin{aligned}
 \text{so total expenditure} &= 40\% + 20\% + 10\% + 10\% \\
 &= 80\%
 \end{aligned}$$

$$\text{Saving} = (100 - 80) = 20\%$$

$$20\% = 1500 \quad (\text{given in question})$$

$$1\% = 75$$

$$\text{Salary} = 100\% = 7500$$

$$\left\{
 \begin{array}{l}
 \text{Salary} = \\
 \text{Saving} + \text{Expenditure}
 \end{array}
 \right.$$

Q. 39 A man spends 12.5% of his salary on daily expenses, 30% of the rest on the house paint, this he is left with Rs. 2940 only. What is his total salary?

Sol:

Basic: Let the salary is x ₹

$$\text{Daily expenditure} = x \times \frac{1}{8}$$

$$\text{Rest of Salary} = x - \frac{x}{8} = \frac{7x}{8}$$

$$\text{Expenditure on House paint} = \frac{7x}{8} \times \frac{3}{10}$$

$$\text{rest money} = \frac{7x}{8} - \frac{21x}{80} \\ = \frac{49x}{80}$$

$$\Rightarrow \frac{49x}{80} = 2940 \text{ (Given in question)}$$

$$x = 4800 \text{ ₹}$$

Trick:

Daily expenditure	Expenditure on House paint
12.5% = $\frac{1}{8}$	30% = $\frac{3}{10}$
So $1 - \frac{1}{8} = \frac{7}{8}$	So $1 - \frac{3}{10} = \frac{7}{10}$

Let Salary is x

$$\text{Saving} = x \times \frac{7}{8} \times \frac{7}{10} = 2940$$

$$x = 4800 \text{ ₹}$$

Q. 40 Rahul spends 30% of his income on entertainment, 20% of the rest income is spent on education of his child, 60% of the remaining money after child's education is spent on house expenses, 20% of the remaining after house expenses is spent on his girlfriend. Now he is left with only Rs. 448. What is the total income?

Sol:

Entertainment	Education	House Expenses	Girl friend.
30% = $\frac{3}{10}$	20% = $\frac{1}{5}$	60% = $\frac{3}{5}$	20% = $\frac{1}{5}$
So: $1 - \frac{3}{10} = \frac{7}{10}$	So: $1 - \frac{1}{5} = \frac{4}{5}$	$= 1 - \frac{3}{5} = \frac{2}{5}$	$= 1 - \frac{1}{5} = \frac{4}{5}$

Let income is x

$$x \times \frac{7}{10} \times \frac{4}{5} \times \frac{2}{5} \times \frac{4}{5} = 448$$

$$x = 2500 \text{ ₹}$$

Q. 41 Mr. Pradeep spends 20% of his total income on house rent and 70% at the rest on house - hold expenses. If he saves Rs. 1,800. what is his total income?

Sol: 7500

Q. 42 Manisha spends 20% of her salary on her child's education, 30% on family, 25% on entertainment. If her savings at the end of a month is Rs. 1250, then what amount does she spend on entertainment?

Sol: 1250

VENN DIAGRAM BASED QUESTIONS:

Q. 43 In a village, each of the 60% families has a Honda car, each of the 30% families has a Hyundai car and each of the families has both a Honda and a Hyundai car. In all there are 96 families in the village. How many families do not have a Honda or Hyundai car?

Sol: There is formula which is generally used in such kind of questions :

$$A \cup B = A + B - A \cap B$$

$A \cap B$ = It is called A intersection B. It means both things are possessed by someone.

$A \cup B$ = It is called A Union B. It means total no. of things which are calculated one thing only for once

$$A \cup B = 60 + 30 - 15$$

$A \cup B = 75\%$. → people who have cars

people who don't have any of these two cars = $100\% - 75\% = 25\%$

So. Such families are = $25\% \times 96$

$$= \frac{1}{4} \times 96 = 24$$

Venn diagram:

